NON-PUBLIC?: N
ACCESSION #: 9112300025
LICENSEE EVENT REPORT (LER)

FACILITY NAME: Clinton Power Station PAGE: 1 OF 06

DOCKET NUMBER: 05000461

TITLE: Waterbox Isolation With Degraded Condenser Performance And Inadequate Steam Jet Air Ejector Suction Alignment Caused Decreased Condenser Vacuum Which Resulted In A Manual SCRAM.
EVENT DATE: 11/16/91 LER #: 91-006-00 REPORT DATE: 12/16/91

OTHER FACILITIES INVOLVED: None DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 027

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
NAME: P. D. Yocum, Director - Plant Operations, Ext. 3205 TELEPHONE: (217) 935-8881

COMPONENT FAILURE DESCRIPTION:
CAUSE: SYSTEM: COMPONENT: MANUFACTURER:
REPORTABLE NPRDS:

SUPPLEMENTAL REPORT EXPECTED: No

ABSTRACT:

On November 16, 1991, with the plant in Power Operation, a rapid plant shutdown with a manual SCRAM was initiated due to decreasing condenser vacuum. The decreasing vacuum occurred during a plant down-power to repair leaking condenser tubes. At 0358 hours, with reactor power decreased to 65 percent, the 'A' waterbox was isolated. Immediately, condenser vacuum decreased and condensate temperature increased, as expected. Condenser suction isolation valve 1CA001A was left open while the waterbox was draining. Condenser vacuum and condensate temperature failed to stabilize. Reactor power was decreased in an effort to maintain vacuum. At 0645 hours, with the reactor at 34 percent reactor power and with condenser vacuum decreasing below 25 inches mercury vacuum, a rapid plant shutdown was initiated followed by a manual SCRAM. The cause of this event was attributed to a combined effect of degraded

condenser performance and valve 1CA001A positioning which resulted in a failure to isolate the air removal pathway ultimately causing a loss of the intercondenser loop seal. Corrective actions for the event include a revision to plant procedures to clarify reactor power limitations prior to isolating a condenser waterbox and to clarify positioning of valve 1CA001A/B prior to draining a waterbox. The main condenser will be mechanically cleaned during the third refueling outage.

END OF ABSTRACT

DESCRIPTION OF EVENT

On November 16, 1991, the plant was in Operational Condition 1 (POWER OPERATION), at 100 percent reactor power. At 0020 hours on November 16, control room operators commenced a scheduled down-power in preparation for isolating the main condenser COND! 'A' waterbox to repair tube leaks.

At 0358 hours, with reactor power at 65 percent, control room operators isolated the Circulating Water SG! system (CW) 'A' waterbox and fully opened 'B' waterbox inlet and outlet valves V!. This caused condenser vacuum to drop from 28.6 inches of mercury (Hg) to 27.6 inches Hg, and condensate temperature to increase from 79 degrees Fahrenheit (F) to 84.8 degrees F. At 0415 hours, non-licensed operators began draining the 'A' waterbox; condenser suction isolation valve ISV! 1CA001A was left open. The Operations Shift Supervisor decided to leave valve 1CA001A open until reactor power was reduced to 50 percent in an effort to maintain non-licensed operator dose as low as reasonably. achievable (ALARA). Station procedure 3113.01 "Circulating Water (CW)" did not state when valve 1CA001A was to be closed. During the isolation and draining of the 'A' waterbox, main condenser vacuum continued to slowly decrease.

At 0440 hours, condenser vacuum had decreased to 27.1 inches Hg. Condensate temperature had increased to 100.2 degrees F. The control room operators expected the rise in condensate temperature and the decrease in condenser vacuum because of the isolation and draining of the 'A'
aterbox.

At approximately 0500 hours, control room operators noted that condenser vacuum and condensate temperature appeared to be stabilizing. However, at 0507 hours, with condenser vacuum continuing to decrease, control room operators commenced reducing reactor power as necessary to maintain main condenser vacuum greater than 27 inches Hg. At approximately 0515 hours,

control room operators noted that condenser vacuum was decreasing at an increased rate while condensate temperature was increasing at an increased rate. No changes in Off Gas WF! system (OG) flow had been observed nor were any abnormal changes in pre-treatment or post-treatment radiation levels noted. The drop in pre-treatment and post-treatment radiation levels observed was attributed to the decrease in reactor power. A post-event review of pre-treatment radiation level history indicated that the radiation levels had dropped sharply at approximately 0530 hours and remained low. This indicates that the steam jet air ejector (SJAE) intercondenser loop seal SEAL! was lost at that time and was never reestablished.

At 0525 hours, with reactor power at 56 percent, OG flow was observed to be slowly decreasing. The Operations Shift Supervisor directed that valve 1CA001A be closed. Subsequently, OG system flow decreased to zero;

valve 1CA001A was reported to be closed. Based on direction of the Operations Shift Supervisor, operators started returning the 'A' waterbox to service.

As a result of 'A' waterbox restoration, condensate temperature was observed to decrease from 128 degrees F to 119 degrees F while condenser vacuum increased from 25.1 inches Hg to 26.8 inches Hg. Approximately two minutes later, these trends reversed. Additionally, the Operations Shift Supervisor directed the control room operators to shift the OG system desiccant beds since there was a possibility that the desiccant bed might be restricting OG system flow due to moisture carry-over. Shifting to the standby desiccant bed did result in an increase in OG system flow to approximately 50 Standard Cubic Feet per Minute (SCF14). However, OG system flow soon decreased to zero. OG system flow surges were later attributed to the entrapped air in the standby bed being pushed past the flow meter.

By 0535 hours, reactor power had been reduced to 40 percent. Chemistry was notified to perform the required sampling of the specific activity of the primary coolant due to a greater than 15 percent reactor power change in one hour as required by Technical Specification Section 3.4.5.

At 0548 hours, the 'A' waterbox had been restored to service. The control room operators started the third circulating water pump P! in an attempt to regain condenser vacuum. Starting the third pump had no impact on lowering condensate temperatures or increasing condenser vacuum. The control room operator shifted the off-gas desiccant beds a second time with the same result that was achieved previously; OG system

flow increased to 50 SCFM then decreased to zero. The non-licensed operators verified the Cycled Condensate KA! (CY) fill valve was open to the SJAE intercondenser loop seal and that the loop seal drain valve was shut. Additionally, the non-licensed operators did not hear a chugging sound coming from the loop seal which, in the past, has been indicative . of a blown loop seal. Therefore, the non-licensed operators were unable to determine if the loop seal had blown. No procedural guidance was available on the correct method to reestablish an intercondenser loop seal once the seal has been lost.

At 0600 hours, non-licensed operators tried venting the main condenser waterboxes without success. Additionally, control room operators began, warming up the 'B' SJAE in preparation for shifting from the 'A' SJAE to the 'B' SJAE. The 'B' SJAE was not initially in standby because it was tagged out of service for corrective maintenance.

At 0645 hours, with the plant at 34 percent reactor power, all the attempts to maintain main condenser vacuum above 25 inches Hg had been unsuccessful. Vacuum had dropped to 24.7 inches Hg. Station procedure 3105.01, "Turbine (TG, EHC, TS)", establishes limitations restricting

operation of the turbine above 1200 revolutions per minute with a condenser vacuum of less than 25 inches HG. Therefore, in order to protect the main turbine from the low vacuum condition, the Operations Shift Supervisor directed control room operators to begin a rapid plant shutdown in accordance with station procedure 3005.01 "Unit Power Changes". A rapid plant shutdown with a reactor SCRAM was initiated rather than simply unloading the turbine TRB! generator GEN! because, initially, reactor power was above the bypass valve flow capability and above the bypass point for the automatic SCRAM on a turbine trip. Although power was subsequently reduced below the SCRAM bypass point and within the bypass capability, a reactor SCRAM was still initiated since vacuum and condensate temperature were still degrading and opening bypass valves would accelerate this degradation. If condensate temperature exceeded 130 degrees F, which was anticipated shortly after opening the bypass valves, the condensate polishers would have been required to be bypassed. Bypassing the polishers is undesirable.

At 0653 hours, with reactor power at 27 percent, the reactor mode switch HS! was placed in the shutdown position to initiate a manual reactor SCRAM. As a result, groups 2, 3, and 20 automatic containment isolations signals occurred, as expected, due to low reactor water level 3. All containment isolation valves were previously in the closed position; therefore, no change in valve position occurred.

At approximately 0705 hours, the reactor was stabilized in Operational Condition 3 (HOT SHUTDOWN).

No other automatic or manually initiated safety system responses were necessary to place the plant in a safe and stable condition. No other equipment or components were inoperable at the time of the event such that their inoperable condition contributed to this event.

CAUSE OF THE EVENT

The cause of this event was attributed to a combined effect of degraded condenser performance and leaving the 1CA001A valve in the open position. The decrease of main condenser vacuum was due to a loss of off-gas air removal capability which was attributed to the loss of the SJAE intercondenser loop seal. Air removal from the condenser is accomplished through a single pipe which divides and penetrates the condenser. Each-air removal pathway can be manually isolated by a condenser suction isolation valve, 1CA001A/B. Draining the condenser waterbox without isolating the affected air removal pathway allows uncondensed steam to enter the suction of the SJAE. This in turn reduces SJAE ability to remove air from the condenser while placing an extra burden on the SJAE intercondenser. Station procedure 3113.01, failed to specify when valve 1CA001A/B was required to be closed.

Additionally, cleanliness of the main condenser was evaluated. The condenser design and station procedure 3113.01 allow single waterbox operation up to 80 percent reactor power. An evaluation performed by the Nuclear Station Engineering Department indicated that the level of condenser cleanliness did impact this event. Scale on the inside of the condenser tubes affects heat transfer capabilities in that the condenser operates at a higher condensate temperature thus reducing the operating margin needed to maintain the intercondenser loop seal. Therefore, the scale on the inside of the condenser tubes, combined with the increased heat load resulting from the inadequate positioning of valve 1CA001A at a relatively high reactor power level was determined to be the cause of this event.

CORRECTIVE ACTION

Station procedure 3113.01 has been revised to provide specific guidance on plant operation utilizing single waterbox operation. The main turbine load is to be reduced to 50 percent prior to single waterbox operation. The limitation of 50 percent reactor power during single waterbox

operations was chosen because approximately four weeks prior to this event, isolation of one waterbox was successfully accomplished at 50 percent reactor power. This procedure has also been revised to require the closing of the condenser suction isolation valve (1CA001A/B) prior to draining a waterbox when a SJAE is in service. These changes have been completed by Procedure Deviation for Revision (PDR) 91-421.

Direction has been added to station procedure 3215.01, "Off-Gas (OG)", for reestablishing the SJAE intercondenser loop seal. The procedure also has been revised to alert operators that system transients or high condensate temperatures may cause a loss of the SJAE intercondenser loop seal. These changes have been completed by Procedure Deviation for Revision (PDR) 91-420.

The main condenser will be mechanically cleaned during the third refueling outage. This is expected to improve main condenser performance and lower condensate temperatures. This work will be done under Maintenance Work Request D23643 and is expected to be completed by the end of the third refueling outage.

ANALYSIS OF EVENT

This event is reportable under the provisions of 10CFR50.73(a)(2)(iv) due to the manual initiation of the Reactor Protection System JC!.

Assessment of the safety consequences and implications of this event indicates that this event was not nuclear safety significant. The decision to implement a rapid plant shutdown was made at 34 percent reactor power by the Operations Shift Supervisor. The decision was based

on condenser vacuum dropping to less than 25 inches Hg and on procedural guidance of station procedures 3105.01 and 3005.01. A rapid plant shutdown with a reactor SCRAM was initiated rather than simply unloading the turbine generator since initial reactor power was above the bypass valve flow capability and above the bypass point for the automatic SCRAM on a turbine trip. Although power was subsequently reduced below the SCRAM bypass point and within the bypass valve flow capability, a reactor SCRAM was still initiated since vacuum and condensate temperature were still degrading. Opening the bypass valve would accelerate this degradation. If condensate temperature exceeded 130 degrees F, which was anticipated shortly after opening the bypass valves, the condensate polishers are required to be bypassed. Bypassing the polishers would have been undesirable. Subsequently, at 0653 hours with reactor power at 27 percent, a manual SCRAM was initiated by placing the reactor mode

switch in the shutdown position. This transient was found to be within the design basis of the plant.

ADDITIONAL INFORMATION

No components failed during this event.

LERs 89-029-00, 88-019-00, and 87-050-00 discuss reactor SCRAMS associated with loss of condenser vacuum.

For further information regarding this event, contact P. D. Yocum, Director - Plant Operations at 217-935-8881, Extension 3205.

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December 16, 1991
10CFR50.73

Docket No. 50-461

Document Control Desk
Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: Clinton Power Station - Unit 1
Licensee Event Report No. 91-006-00

Dear Sir:

Please find enclosed Licensee Event Report No. 91-006-00: Waterbox Isolation with Degraded Condenser Performance And Inadequate Steam Jet Air Ejector Suction Alignment Caused Decreased Condenser Vacuum Which Resulted In A Manual SCRAM. This report is being submitted in accordance with the requirements of 10CFR50.73.

Sincerely yours,

F. A. Spangenberg, III
Manager, Licensing and Safety

JDP/alh

Enclosure

cc: NRC Clinton Licensing Project Manager
NRC Resident Office, V-690
NRC Region III, Regional Administrator
Illinois Department of Nuclear Safety
INPO Records Center

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